

LESSONS of the STORM

Forty Photo
Illustrations

Concrete reinforcement

Jones & Laughlin Steel Corporation
Pittsburgh

J & L

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Lessons of the Storm

A Brief Engineering Study

OF THE EFFECTS OF THE RECENT
HURRICANE ALONG OUR SOUTHERN
COASTS UPON VARIOUS TYPES OF
BUILDING CONSTRUCTION



Illustrations from photographs
taken by Construction Engineers
of the

**JONES & LAUGHLIN
STEEL CORPORATION**

American Iron and Steel Works

Pittsburgh, Pa.

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JONES & LAUGHLIN STEEL CORPORATION

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THESE studies of the effects of the recent hurricane upon building construction of all types in Florida were made by the Jones & Laughlin Steel Corporation for the purpose of ascertaining for its own information and benefit just what these effects amounted to and what significance they held for the builder and the manufacturer of building materials.

The work was done by a corps of Jones & Laughlin construction engineers. The photographs and the observations made by these experts in construction proved so interesting to this organization that it was decided to put them together in this form and make them available to others who might be interested.

In addition, through the courtesy of Mr. Louis Brandt, of Pittsburgh, we have incorporated herein some observations made by him, in his capacity of housing engineer, in the districts affected by the storm, which will be of particular interest to those concerned with dwellings, as his studies were directed principally to that type of construction.

This booklet is presented to you with our compliments and in the hope that you will derive benefit from studying its contents and analyzing the observations and the illustrations.

JONES & LAUGHLIN STEEL CORPORATION

A handwritten signature in black ink, appearing to read "J. E. Shackett". The signature is fluid and cursive, with a large, stylized 'J' at the beginning.

Vice President

Pittsburgh, Pa., November, 1926.

Observations by J & L Construction Engineers

BUILDINGS which were well designed and well constructed came through the supreme test of the hurricanes in excellent condition. Buildings which were poorly designed and indifferently constructed suffered heavily. The foregoing applies to all types of buildings and all kinds of building materials.

It is significant that a large proportion of the buildings which best weathered the gales and floods were designed by architects and engineers, and constructed by contractors thoroughly acquainted with local conditions.

As an example, one need only observe the large number of imposing structures in Miami—such as hotels and office buildings—which were so well designed and constructed that they came through the storm structurally sound. Broken windows, water-ruined floor coverings and decorations, damage caused by debris flying through the air do not in any sense denote poor design or careless execution.

Big buildings of steel frame construction stood up to the storm unyielding, with one notable exception. This was a high, narrow structure accused of having faulty design. After removal of portions of its curtain wall, this building will be subjected to exhaustive studies by engineers to ascertain the causes of its failure.

Structural steel buildings, properly braced, of the mill or garage type withstood the storm splendidly, excepting where damaged by the failure of other portions of the structure. In some such cases where the roofing material was blown off, either entirely or in part, the structure itself stood steadfastly protecting the contents of the building from complete destruction.

On the other hand, mill or garage type buildings constructed with poorly designed wooden trusses collapsed with heavy losses not only to the buildings, but to material within.

The greatest damage to dwellings occurred among those of hollow tile and cement block construction, erected during the boom period. Yet, where well-designed and constructed, many houses built of these materials withstood the storm. Loss of roofs and partial or total

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collapse of this type of structure, invariably followed poor workmanship.

Great numbers of dwellings had roofs or cornices of Spanish tile. When properly applied, as was the case of many of the homes in Coral Gables, the roof damage was slight, but wherever tile were poorly secured they became easy prey to the violence of the winds because of their shape, were broken and ripped off and driven before the hurricane as jagged fragments—a menace to other property and to life.

Such failures as occurred in reinforced concrete construction, usually appeared to be due to faulty design. Amply strong to withstand vertical loads, reinforced concrete columns and girders, suddenly subjected to terrific horizontal thrusts (which was the direction of greatest force of the storm) failed and collapsed in those cases where they had not been sufficiently tied together or wind-braced.

Frequently it was observed that poorly constructed roofs or curtain walls were entirely blown away from structures that were otherwise stable.

The comparatively few frame buildings with shingle roofs, such as residences of the older type, came through the storm, as a rule, without much damage.

The principal damage to the larger types of buildings of steel, or steel and reinforced concrete construction was from the horizontal thrust of the tempest of rain that accompanied the hurricane, from driven water, flying timbers out of weaker buildings, falling stone and other building material, uprooted trees and similar heavy objects hammered into the buildings by the incredible force of the storm.

There are but few structures built of brick in the areas affected by the storm, but such as there were stood up excellently.



The terrific thrust of the storm and its accompanying high water are well illustrated by this picture of an ocean-going barge driven up on the Hollywood golf links.

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Small Building Construction As Affected by the Storm

NOTE—*The following observations were made by Mr. Louis Brandt, who, as a Housing Engineer, was interested principally in the storm's effects upon dwellings.*

WHILE the storm area of Florida has suffered great loss it is not irreparable by any means. Building losses are being quickly restored. It will, however, take some time for nature to repair its damage. There is in evidence a wonderful spirit that is bound to insure rapid progress not only in restoration work but in new developments to meet the demands and needs of the substantial and permanent growth that is bound to come. One is impressed with the sincerity and ability of the local business men. Their capable leadership has been thoroughly demonstrated. They have shown a resourcefulness to the extent that they are worthy of the confidence of the entire country.

Building losses due to the Florida storm can be taken as a valuable lesson to construction men and every section of the country can benefit from these observations. There is a present need for safer, more permanent and lasting construction, especially in low cost homes.

In this report, small building construction is the principal type discussed, as here is where the losses were found that represented the greatest burden. With the exception of one or two large buildings, the skyscrapers, business buildings, and hotels of Miami suffered practically no structural damage, as these buildings as a matter of necessity were well designed, employing sound engineering and competent workmanship.

My study of materials and workmanship disclosed the fact that whereas certain materials failed, the blame lay more with the manner of handling than with the actual materials themselves.

Types of Buildings Destroyed

It was found that several types of buildings had been entirely destroyed. This was especially true of one-story commercial garage buildings. These buildings in most cases had truss roofs so as to elimi-

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nate column supports within the buildings. The truss roof construction was a heavy dead load alone on light walls and when undue wind pressure came upon them it brought about a collapse of the entire building. Apparently little preparation had been made for much additional load as this was thought unnecessary in so mild a climate.

In some cases an attempt had been made to build reinforced concrete columns in outside walls to carry the roof loads. Here failure was due to the fact that these columns were started on top of foundations without any studs or steel connections. The amount of steel used, wholly inadequate from a proper design standpoint, consisted of but three or four small rods running to the top of the column or plate line. The concrete block in this construction was not built into the column but merely joined thereto. When the panel blew out, the wind got under the large roofs and lifted them off, bringing about the collapse of such buildings.

Cement Block Construction

Cement blocks in house construction stood fairly well, except where parapet walls blew off. This could have been prevented to a great extent if more care had been used in bonding, coping, etc. Where these walls blew off, the roofs were not strong enough to withstand the load, thus bringing about the collapse of the buildings. Other types of tile block masonry construction also showed failure, but as the cement block had been used more generally, the writer has dwelt with this type of building unit from the fact that it is used so extensively throughout the country and it should not be condemned. However, it must not be considered a “foolproof” building material by any means. It requires as careful application and competent workmanship as steel, brick, stone, reinforced concrete, wood construction or any other proven material.

Wood Construction

While it has been stated quite generally that good carpentry stood the test well, this is not true except where buildings were new and the wood had not begun to decay. It was observed that some wood decays very rapidly in this climate, especially second growth lumber. This decaying began where the wood studding joined at the sills and joist

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bearings of the first floor, also at corner connections that had not been protected by water-tight covering of either wood or water proof stucco. Apparently neither care nor discretion prevailed in selecting wood for the structural part of the frame buildings as is mostly the case, it being considered that any old thing was good enough if covered up. This has been the practice too frequently in late years in the framing work of our small houses everywhere.

While stucco exteriors were most generally used either over masonry construction or wood frame houses, a great many small houses were built entirely of wood, that is, with clapboard or other siding for outside wall covering. This practice is not to be recommended in this climate in view of the recent storm, as it is almost impossible to make it water-tight, especially around window and door openings. If wood is desired for this purpose, then wood shingles would undoubtedly be the better way to cover outside walls, as the size, shape and overlapping of shingles would make a water-tight job and of necessity would have to be flashed around openings.

Reinforced Construction

Wood framed buildings having stucco exterior with stucco put on over wood lath composition or fibre wall boards generally failed, as the wind pressure racked and twisted the structure, thus breaking the keys or bonds which are employed to hold the stucco slabs in place. In some cases poultry wire was put on over these materials effecting a tieing together not only of the stucco base but of the entire structure. This tieing with wire demonstrated a value, although wire with hexagonal mesh showed no reinforcing protection.

Most of the frame buildings that stood the storm test were those built of studdings spaced 16 inches on center, properly doubled at openings, with wind bracings cut into the studdings at corners and then diagonally strip sheathed, which means using lumber 1 inch thick by 4 or 6 inches wide, nailed diagonally over the outside of studs and spaced from 6 to 10 inches apart. This brought about a well secured and braced frame work. Over this, a 2 inch by 2 inch paper backed rectangular mesh of heavy, welded wire reinforcement was placed over all of the outside walls with the joints well lapped so as to affect a continuous covering over the entire structure, thus binding and tieing the entire building together. When stucco was applied,

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this wire mesh became an integral part of the slab, thereby bringing about in addition to structural advantages, complete reinforcement of the cementitious materials.

It has been most generally accepted in building practice that if a substantial foundation has been built and a good roof placed over the structure that most any type of superstructure work will give lasting service, providing it is built of such materials and in such a way as to resist the elements of cold, heat, rain and wind pressure. In this respect Florida in consideration of its mild climate had not given sufficient consideration to foundation work.

Foundations

Two courses of cement blocks laid almost on top of the natural surface were thought sufficient for this purpose as there were no frost disturbances to be met. Foundations thus built failed, due to the undermining soil and sand movement caused by rains. In future building, consideration must be given to foundations by placing them deep enough in the ground to overcome the defects mentioned.

It appeared that houses built in this climate would be more satisfactory to the occupants if first floors were at least 30 inches above grade level. Foundations should be built to a depth of at least 24 inches in the ground and walls to the first floor supports should be built just as substantially as has been found necessary in the frost area. In some locations these walls should be reinforced and provision made for securely anchoring the building or superstructure to the foundations, whether built of masonry or frame construction.

Roofing

If figures were available to show which item of construction was more responsible than any other for direct and indirect losses, roofing would show very high in the percentage. Most every kind of roof suffered. Tile, which is one of the oldest and best types, was blown off, most generally due to its being open and depending much upon its own weight to hold it in place, but one nail being employed to keep the tile from slipping. The hurricane winds got under these tiles and raised havoc. Where tile was laid in and closed up at the ends with cement, it withstood the storm.

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Wood shingles stood best where they were properly applied, due to the rigidity and overlapping application. Rag felt, asphalt, stone surfaced shingles withstood damage where they had been or became cemented at the butts. Built-up roofs stood up well enough, where they had been applied to keep the wind from getting under them at any point. A study of roofs discloses that the hip or conical shaped roof suffered less than those with gables, flat or parapet walls. In any event, every type and design of roof construction needs secure anchoring to main walls and if roof covering had been used that cannot be lifted by winds and the base for roofs substantially constructed, it would have prevented a large percentage of losses, as suffered in the recent storm.

Recommendations

1. Foundations for house construction should be built to meet any local emergency. Depth of excavation should be not less than 24 inches and in all cases deep enough to secure solid soil. Monolithic or poured concrete will make a secure foundation, having the base or what is known as the footers about 6 inches thick and 18 inches wide. On top of this, build the concrete wall, 8 inches thick for frame foundation, and 12 inches thick for masonry foundation would be sufficient. Foundations should be carried to a height of not less than 30 inches above finish grade, with sufficient vents on the four sides to effect circulation of air under the first floor. Provision should be made in finishing the top of the foundation to anchor the superstructure or the building securely thereto by the means of bolts bedded in the foundation so that sills, especially for frame work, can be secured with the bolts spaced not less than six feet apart. If the load bearing of the soil is uncertain, then reinforcing rods should be used in the footers and in some cases in the walls also.

2. The superstructure walls of the building above foundations should be constructed to withstand hurricane and storm conditions. Only weather-tight, waterproof walls, as well as metal weather stripped doors and windows should be used. If buildings are constructed of wood, or what is commonly known as frame construction, the structural parts thereof such as sills, joists, studdings and rafters should be from first growth or lumber from virgin timber and not from the second growth commercial stock that is now so universally offered on the market. The studding frame work of outside walls should be

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wind-braced at all corners. Sheathing over the outside of studding, whether of the strip or solid practice, should be placed diagonally over the studs to bring about complete bracing. If wood exterior, whether shingle or clapboard is used, it should be underlined with heavy waterproof building paper. Houses having wood covering on the exterior walls should be flashed securely to the window and door frames. Waterproof stucco exteriors are more suitable in this climate from the standpoint of good effect, and can be made weather-tight around door and window openings and actually cement them in place, but in no event should stucco be used on wood frame construction, except with a reinforced base made of 2 x 2 rectangular mesh galvanized wire, which was found stood the storm test

If walls are built of masonry with hollow tile or cement blocks, this material should not be considered, except that which has been properly manufactured and which will withstand a crushing test of not less than 1,250 pounds to the square inch. Hollow block walls must also be covered with waterproof stucco to prevent leakage and while these walls have air cells, they will not prove entirely satisfactory unless furred off on the inside, providing a continuous air space between the interior plaster and the superstructure walls.

3. Roof framing should be securely anchored to the superstructure walls. In the case of masonry, bolts should be built in to the top of wall, to secure the plates for rafters and the rafters spiked thereto. The rafter framing should be of timber of sufficient strength and spacing to stand hurricane wind pressure. The minimum requirement for small houses would be 2 x 6 material, spaced not less than 16 inches on center, covered with $\frac{7}{8}$ -inch sheathing, double nailed to all rafters. Cornices should be constructed, whether of the open or closed type, so there will be no leakage or chance for wind to get under the main roof. The investigation showed that wood shingles could be safely used, also asphalt stone-surfaced shingles, when properly cemented or secured at the butts. A means of closing the ends and better securing tile roofing, will have to be employed to make this material hurricane proof.

It is to be recommended that the minimum of sheet metal be used for roofs or flashing, as ordinary tin or galvanized iron disintegrates very rapidly in this climate. Copper or zinc should give a lasting service and due to the small amount of sheet metal required in the average house, will justify its use at the small additional cost over ordinary metal.

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4. First floors of houses or living apartments should be elevated above finish grade not less than 30 inches and provision made for free circulation of air under first floors. This is important to prevent dampness that prevails during the rainy season.

Consult Competent Authorities

Bearing in mind the foregoing suggestions, it is always advisable to consult capable authorities on building construction, regardless of the size of the project, before proceeding with the work. Designs, specifications, and conditions, varying in practically every case and locality, require individual consideration.

While standard plans, distributed by various reliable sources, may assist in arriving at certain preliminary conclusions, actual specifications for materials and workmanship should always be determined by those authorities who, familiar with local conditions and practices, can protect the uninitiated from possible disappointment after the erection of the building.



A result of poor design and inferior workmanship.
Wreck of a bathing pavilion.

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Deductions from the Observations

THE outstanding conclusion reached by construction engineers of the Jones & Laughlin Steel corporation who studied the effects of the hurricane, is that good designing and good construction invariably pay for the time and expense put into them. Indifferent designing and hasty construction are not profitable. In this instance a terrific hurricane was the test. In other instances other forces of nature have similarly tried the design and workmanship of construction and, without exception, have proven the profitableness of good work.

It is not necessary to wait for upheavals of nature to prove the case for good design and good craftsmanship. Time, the greatest leveler of them all, will do it. Time would have tested construction in the path of this great tempest and would have shown favor to quality work and cast down inferior production. A hurricane, an earth tremor, a conflagration are merely short cuts to the ultimate result. They attract universal attention by their terrifying effect and sudden accomplishment, but only teach the lesson that time teaches, namely, that good construction pays big dividends.

Another lesson of the great storm is that the best design and workmanship can be obtained from men trained in the requirements of the locale, from the architects, engineers and builders who have made a study of the conditions applying to the vicinities where building is to be done, and know what is best adapted for good design and good construction, both as to the materials themselves and their application.

Manufacturers of building materials will do well not to lose sight of this fact and to withhold from rushing their products into the affected areas for application to the heroic task of reconstruction without regard to whose hands they fall into for that application. The advice of men thoroughly acquainted with all local conditions should be assiduously sought and followed, or the risk is run of employment of worthy construction materials in a manner to condemn them in the eyes of the building owner or occupant.

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Property owners in the storm areas are confronted with two problems; first, that of repair of damaged structures; second, that of building anew on the sites of destroyed structures. To solve both of these problems in the best interest of themselves and their respective communities the owners should have the cooperation of manufacturers of building materials to the extent, at least, of not going in for construction methods or design ill suited to the several uses and localities. They should look first to their own architects, engineers and builders for counsel, and these, in turn, should draw from the limitless stores of knowledge of the leading manufacturers of construction products throughout the United States as to suitable materials which can be adapted to special conditions.

There is one warning, and a significant one, which this corporation would sound, and that is against the indiscriminate employment of building materials shipped in from abroad merely because foreign manufacturing conditions permit such material to be laid down on our shores at cheap prices. The constructor or property owner who is tempted by the prices at which these materials are offered, due to low wages abroad, low transportation costs in subsidized foreign bottoms and low costs on raw materials, should remember, first of all, that such products once acquired cannot be returned on claims on account of damaged condition, inferior quality or faulty workmanship. There are no commercial customs whereby replacement may be had for goods that prove to be inferior. There is no spirit in the manufacturers of foreign building material favoring assistance to a stricken American community. There is only one object in the mind of the foreign producer, namely, to find a market at any present sacrifice and with no consideration for American standards of business and American levels of wages and profits.

No one is more interested in good building construction than the Jones & Laughlin Steel Corporation. For more than three-quarters of a century we have been producing building construction materials and selling them for application under conditions which will not condemn those materials through no fault of their own. We are jealous of our good name and will not at any time knowingly place our products in hands which will jeopardize that good name by careless application of those products so that a default in design or construction may be blamed upon the materials themselves.

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In the long years that Jones & Laughlin have been making building materials we have never failed to keep a step ahead of good practice. The result has been that we have designed and perfected various new products from time to time as we foresaw the coming trend of building. For an example, we have within the year brought out a new building product for which the need was long foreseen and which we are confident is going to play an important role in all future building. This is the new JUNIOR BEAM, a rolled steel structural section, about one-third the weight of standard structural beams, especially adaptable under all existing engineering formulas to the construction of floors and roofs in all types of structures from skyscrapers to dwelling houses, and with great possibilities in the near future for application in the construction of dwelling houses of steel frames throughout, as office buildings are now constructed. Further reference to this new product and other J & L construction products will be found in this booklet.



Bay Shore Drive, Miami. Boats and barges driven ashore by wind and water.

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Striking Contrasts



HOLLYWOOD—Ruins of a poorly constructed garage building. Wooden trusses and tile walls with slender reinforced concrete columns. A large number of cars under the wreckage.



MIAMI—A well designed steel frame garage building. Roof sheeting blown off and a few tile missing from the end wall, but no other apparent damage.

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Fort Lauderdale District



Ruins of one wing of the High School, a building of tile, plaster and stucco construction with wooden floors. This view shows the upper story completely blown away.



Another view of the High School building, showing additional details of the damage wrought upon this type of construction. Other school buildings in the same group were badly damaged.

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Fort
Lauderdale
District

Additional views of the ruins of the High School building. The type of construction shown in detail in the lower picture was common in this district, with cement block frequently substituted for tile.

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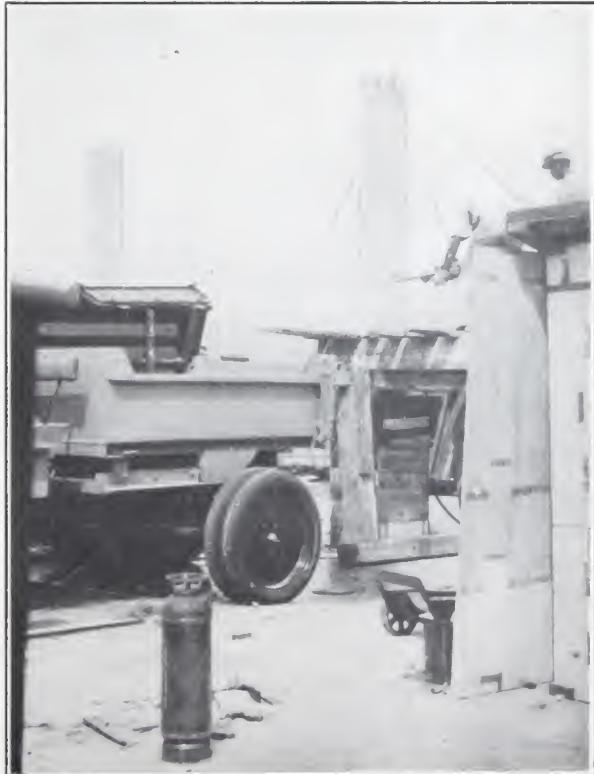
“LESSONS OF THE STORM”



Miami

This is a reinforced concrete building, with tile or concrete block curtain walls.

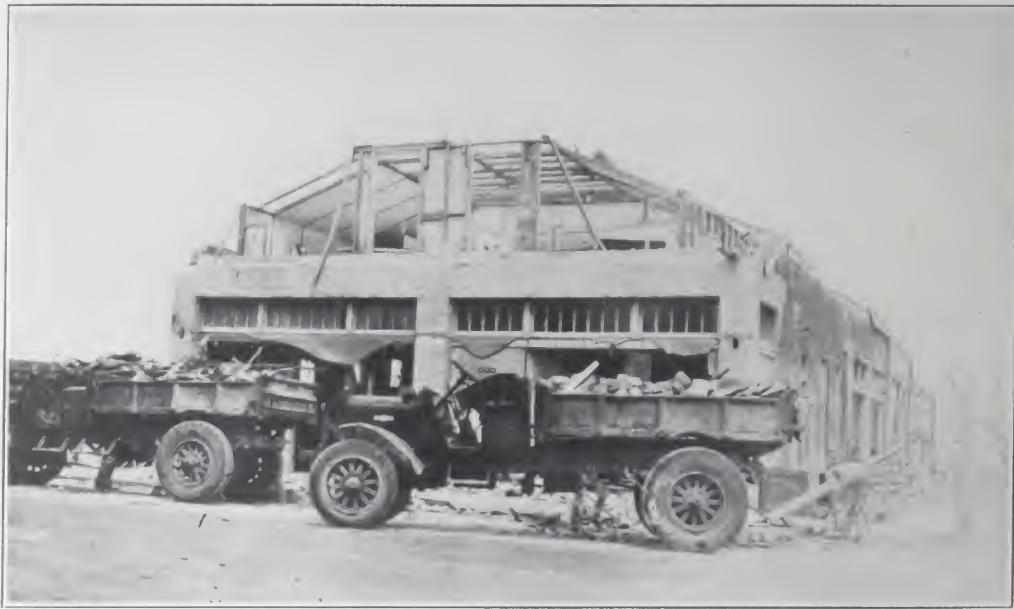
The roof and walls of the upper story were blown away. Some concrete columns of the upper story remain and are being removed with difficulty.



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Fort Lauderdale District



The above picture shows the ruins of a store and office building.



This picture depicts the ruins of Carpenters Hall, an unfinished building. Failure of the upper walls allowed the roof to collapse.

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Fort Lauderdale District



The large building to the left is an unfinished building on which work had been suspended for some months. This was probably due to sudden end of real-estate boom. Buildings badly damaged by storm are also shown.



Ruins of open-air Theatre. Walls and band-stand blown down.

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Fort Lauderdale District



Ruins of Electric Company's building.



A garage building which had the upper story blown off.

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Miami



This garage building had roof blown off and walls of upper story badly wrecked. The steel trusses shown were of light design with very light bracing. Although some truss members were bent, none had failed and trusses were in position except as pulled out of line by failure of other portion of structure. Purlins were wood joists.



A ruined car on the second floor of building shown above.

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Miami

Above — Damaged building of the Shackelford Motor Company.

Left — View of upper story of Shackelford Motor Co. building, showing workmen engaged in removing the concrete columns which did not fail.

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Miami

The Bay Shore Drive district of Miami was exposed to the full fury of the storm.

The upper picture shows hotels and office buildings along this celebrated thoroughfare that withstood the hurricane apparently without structural weakening, although damaged by water and flying debris. Barges and small boats are strewn along in front of these big buildings.

Picture to right shows how bungalows were in many instances damaged by uprooted trees blown against them.



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This building is 17 stories high and less than 50 feet wide in front and 40 feet in the rear. Investigations are now in progress as to the cause of the failure and best method of reconstruction.

Miami

Views of the Meyer-Kiser Bank and Office Building. This is the outstanding example of tall building failure in the storm-swept area.



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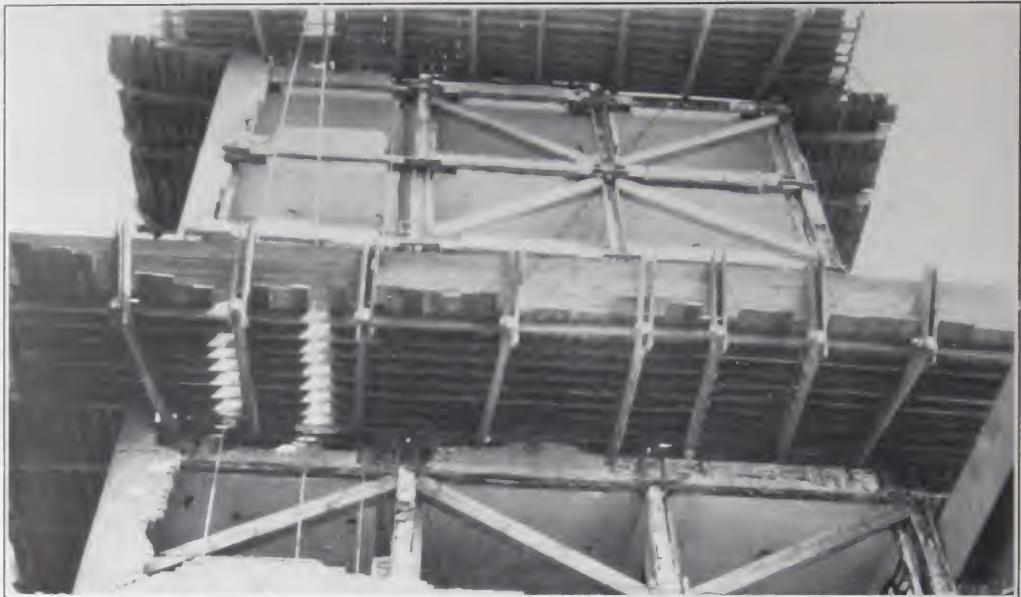
Miami

Other views of the Meyer-Kiser Bank Building.



A detail of the reconstruction work on this building is shown on the next page.

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Miami

Above—Temporary bracing on the front of the Meyer-Kiser Bank Building. Also scaffolding for removal of curtain walls.

The picture to the left shows the ruins of a grocery store in the Fort Lauderdale district.

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West Palm Beach

The upper picture shows one of the few cases of failure in this vicinity, a careless application of cement block.

Lower picture shows the floods driven in on West Palm Beach by the fury of the gale.



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Palm Beach
and
West
Palm Beach

These views show by the condition of the foliage that comparatively little damage was done in this section.

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Hollywood

Ruins of the Professional Building. Picture to the right shows reinforcing rods torn out of the concrete column.



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Miami



Badly damaged boat washed up on roadway. Workmen are restringing wires which were blown down.



Another damaged boat which was driven over the road shown above, and into adjacent field.

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Hollywood



Ruins of Methodist Church. Concrete and tile structure. Failure apparently due to insufficient bracing.

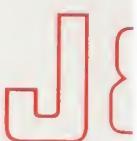


Badly damaged apartment house.

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CCA



THE MARK
ON STEEL

PRODUCTS OF THE
Jones & Laughlin Steel Corporation
Applicable to Construction



WITH the reputation and the experience gained in more than three-quarters of a century in the business of manufacturing iron and steel products, under one management and direction during this long interval, presenting to our customers the opportunity and advantage of purchasing all their requirements in steel commodities from a single nation-wide sales organization, we take pleasure in showing you in the following pages some suggestions which should prove to be of value to one who is interested in the construction industry



JONES & LAUGHLIN
STEEL CORPORATION

The Junior Beam

An Exclusive Jones & Laughlin Product



THE reception accorded the J & L JUNIOR BEAM in the building field has been remarkable. It is being hailed as an economical solution of many construction problems and is destined to supply a very real need in steel construction. The J & L JUNIOR BEAM is a rolled-steel, structural section, approximately one-third the weight of standard structural sections of corresponding sizes. The JUNIOR BEAM is applicable under existing formulas to many building uses, notably in construction of floors and roofs in office buildings, hotels, apartments, hospitals, schools, public buildings, major garages, farm buildings and other large structures.

Its application to the field of dwelling construction is only begun and we can foresee its influence in bringing about the era of the "all-steel" house. We are conducting experiments in this field and eventually will be able to advise more fully on this aspect of the new structural product—the JUNIOR BEAM.

The use of the J & L JUNIOR BEAM will materially aid in reducing the large fire losses annually inflicted on every community and will effect economies in costs of insurance. When properly used the cost of this type of fireproof construction is within the reach of all.

The Jones & Laughlin Steel Corporation maintains an engineering department which is making a special study of these sections, and their application to engineering and architectural work. Advice based upon knowledge gained will be cheerfully given upon request.

We are prepared to furnish material coped or cut to other than right angles, as well as to do special punching.

We furnish all necessary accessories, including special hangers, bridging, screed or nailing strip chairs, special clips for attaching metal lath, as well as tools for fastening.

Material available for prompt shipment from PITTSBURGH and CHICAGO. Additional details of design given in the Special Illustrated Bulletin No. 2.



Sizes, Weights and Functions of J & L Junior Beams

Depth	Weight Lbs. Per Ft.	Flange Width	Web Thickness	Area Sq. In.	Radius of Gyration		Moment of Inertia	Section Modulus
					Vertical Axis	Horizontal Axis		
6	4 16	1 85 ^{1/2}	0 11 ^{1/2}	1 22	0 3525	2 353	6 77	2 26
7	5 10	2 04 ^{1/2}	0 12 ^{1/2}	1 50	3784	2 722	11 10	3 17
8	6 12	2 23 ^{1/2}	0 13 ^{1/2}	1 80	4046	3 086	17 13	4 28
9	7 23	2 42 ^{1/2}	0 14 ^{1/2}	2 13	4307	3 449	25 31	5 62
10	8 42	2 61 ^{1/2}	0 15 ^{1/2}	2 48	4571	3 809	35 95	7 19
11	9 74	2 80 ^{1/2}	0 16 ^{1/2}	2 86	4827	4 171	49 83	9 06
12	11 13	2 99 ^{1/2}	0 17 ^{1/2}	3 27	5080	4 531	67 19	11 20

Write for Junior Beam Bulletin No. 2

J & L CONSTRUCTION PRODUCTS

Junior Beams As Structural Sections



Junior Beams in the floors of the Penn-Lincoln Hotel, Wilkinsburg, Pa.
Janssen & Cocken, Architects, Pittsburgh, Pa. E. Z. Peffer, Contractor, Wilkinsburg.

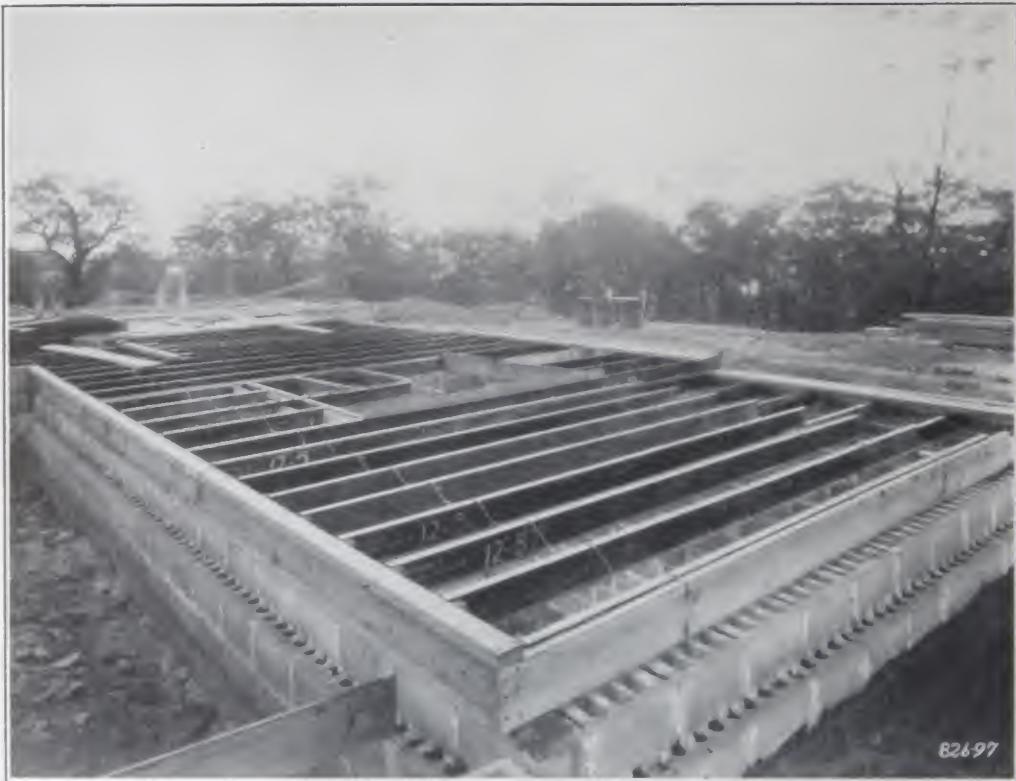
OBSERVE the blending of J & L JUNIOR BEAMS with the standard structural steel. Time and money saved by having the floor beams placed while the structural steel goes up. The JUNIOR BEAMS form a support for working floor platforms, obviating necessity for temporary timber scaffolding, and cost for setting it up, as well as assuring safety to workmen from start to finish of the job.

The type of construction shows JUNIOR BEAMS cut to length and in position in the special J & L hangers designed for the purpose. With the hangers economically fastened to the standard structural members and the JUNIOR BEAMS dropped in place, the erection of this type floor is complete at a minimum of cost. Temporary planking can be used until the JUNIOR BEAMS are all installed ready for the metal lath and concrete floor slabs to be set.

See Working Tables in Bulletin No. 2

J & L CONSTRUCTION PRODUCTS

Fire Risks in Dwellings Reduced by Junior Beams



First floor of country residence of C. L. Snowden, Pasadena Drive, Allegheny County, Pa., Bartholomew & Smith, Architects, Pittsburgh, B. L. Winner Company, Contractor, Pittsburgh



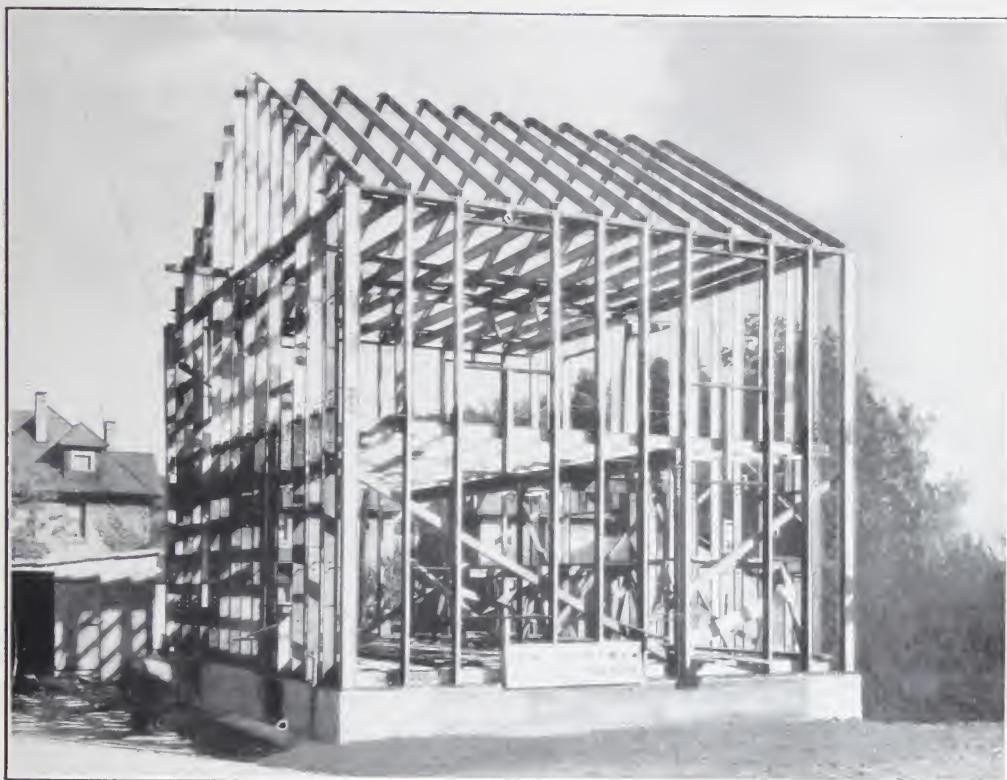
BY SPECIFYING the J & L JUNIOR BEAM, the new, light weight, rolled steel structural section, the architects of this dwelling know that they have eliminated the major part of the risk of fire breaking through from the basement and destroying the costly home. The construction of the first floor consists of JUNIOR BEAMS supported on the foundation walls and on the steel work and properly protected against fire by plastered ceiling on metal lath on the under side of the floor members.

If fire should originate in this basement (where 75% of them do originate in residences) it could burn for two hours before communicating itself to the rest of the structure. Since there is small likelihood of there being enough combustibles in a dwelling basement to sustain a fire for that length of time, it is obvious that this type of floor construction greatly minimizes the dreaded fire menace of the rural districts, where no immediate aid is at hand.

Consult Your Architect on Advantages

J & L CONSTRUCTION PRODUCTS

“All Steel” House a Possibility with Junior Beams



Showing a residence framed with Jones & Laughlin Junior Beams



HE “all-steel” house is in sight for American homes and multiple dwellings of all kinds, where safety is a consideration of first importance. With the new J & L JUNIOR ROLLED STEEL BEAMS, it is possible to frame up a house in steel, exactly as the skyscraper is framed up today—floor joists, ceiling beams, studding and rafters, all of steel, with floors, walls and roofs made of fireproof materials, thus producing a structure that becomes practically indestructible in the event of fires, winds or earth tremors, offering the maximum of personal safety as well as of economy in insurance rates and durability of construction.

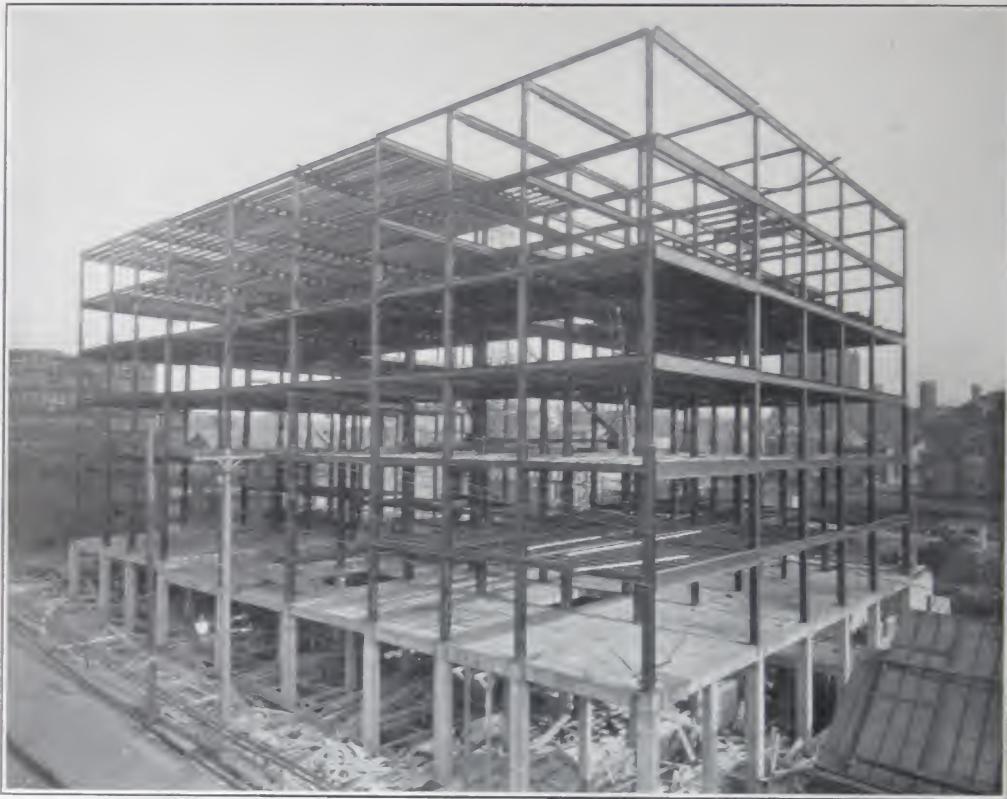
The use of wood for flooring and interior trim and other parts not constituting a major fire risk may still be continued under the system now being developed for using JUNIOR BEAMS for framing buildings, if so desired by the builder and owner.

Another feature of the new type of construction developed by the new rolled steel JUNIOR BEAMS, is that buildings become proof against vermin of all kinds, such as rats, mice and roaches.

Protect Your Home with Steel Construction

J & L CONSTRUCTION PRODUCTS

J & L Structural Material



This is a building in which Jones & Laughlin structural material was used throughout.



EVERWHERE that building goes on you will find Jones & Laughlin angles, beams, channels, tees, zees and special shapes fabricated by others or ourselves, into columns, girders, trusses and other construction material, and giving splendid service in all manner of construction, from the tallest skyscrapers to the smallest highway bridges.

One of the huge palaces in the Sesqui-Centennial Exposition in Philadelphia was awarded to us solely because of the engineering skill with which we demonstrated to the constructor and the Exposition authorities how the mammoth structure should be constructed for greatest strength with the minimum of material.

Jones & Laughlin manufacture a complete line of angles, beams, channels, tees, zees and other structural shapes, and plates for bridges, tanks, barges, cars, ships and every other use.

Your Fabricator Will Estimate

J & L CONSTRUCTION PRODUCTS

J & L Mill and Factory Buildings



This factory building was constructed by Jones & Laughlin of
J & L fabricated material.

MANY manufacturers throughout the country, big and little, have turned to J & L for the design, fabrication and construction of their factory buildings. This branch of our manifold activities has become highly specialized and has built up a reputation that is nation-wide. The engineering force in our Steel Construction Department are men who have become highly trained in mill and factory building work and whose advice and experience are invaluable to any manufacturer contemplating new construction.

In every large manufacturing center of America we can point out mill and factory buildings which we have designed and fabricated and which are rendering steadfast service and giving complete satisfaction to their owners.

Consult Us on Your Next Mill Building

J & L Diamond Bars for Concrete Reinforcement

(Straight, bent or fabricated)



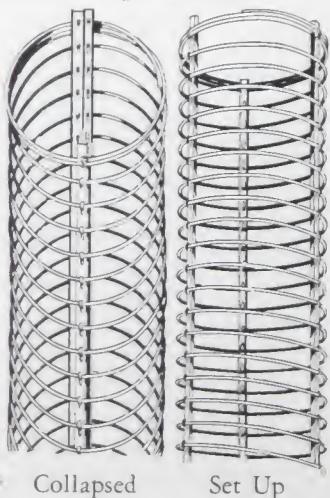
Round Equivalent Deformed



Square Equivalent Deformed

Advantages of J & L Diamond Bars

1. Each bar has uniform cross section, without offsets, carrying the stresses uniformly.
2. The ribs are clean-cut and accurate, balancing each other in two opposite spirals.
3. The ribs run at angles of 45 degrees, giving maximum areas to resist slippage.
4. There are no sharp edges or corners, thereby assuring intimate and thorough contact with the concrete.
5. The sizes are easily identified, round sections for the standard round equivalents, gothic square sections for the squares.
6. Diamond bars are rolled from new billet steel, tested to the standard specifications.



Furnished in Structural Steel, Intermediate and Hard Grades conforming with Manufacturers' Standard Specifications or others mutually acceptable.

J & L Spirals

for concrete reinforcing. These spirals are made with two or three spacers, as desired. They are rigid and substantial. Ready to set in forms. Shipped collapsed. Large stocks on hand.

J & L CONSTRUCTION PRODUCTS

J & L Steel Pipe for Buildings



When you see this signal — look for the good STEEL PIPE

DISTRIBUTORS of *J & L PIPE* hang out this bright red emblem from their loaded trucks and wagons as if saying—“There goes pipe any man can be proud of—good, clean, true J & L Steel Pipe.”

Men who work with pipe never fail to approve J & L Steel Pipe. It cuts clean, strong threads, they say, has great strength at the weld, is ductile, uniform, true to size and finally is just naturally clean and free from excess scale.

But read what a man says, who for forty years has been working with all kinds and makes of pipe. This man is shop foreman for one of the largest pipe jobbing houses in Ohio. The firm wrote to us extoling the merits of J & L pipe because it gave the best results in their shop of any pipe they had ever used. In the letter occurred this sentence:

“Our shop foreman, who has been cutting pipe for approximately forty years, claims that your product is superior to any he has ever used.”

We have many similar voluntary expressions of satisfaction in the results pipe users have obtained with J & L STEEL PIPE.

J & L STEEL PIPE, Plain or Galvanized is designed for water lines and gas service, and all other applications in the building field.

Each piece of J & L pipe is rigidly tested and inspected. The name JONES & LAUGHLIN is rolled in every length as your protection against substitution and our signature on a product of which we have every reason to be proud. We manufacture complete lines of standard pipe, line pipe, casing, tubing, drive and rotary drill pipe.

Specify J & L Pipe in Your Next Building

J & L CONSTRUCTION PRODUCTS

J & L Steel Wire Nails

Bright — Coated — Galvanized — Annealed — Blued



JONES & LAUGHLIN Nails and Wire Products, in common with all lines of Jones & Laughlin manufacture, represent the best article of the kind which prime materials, modern facilities, conscientious workmanship and painstaking supervision can provide, and as such are truly worthy of the designation "Standard."

The ore is drawn from our own mines, reduced in our own blast furnaces, converted into steel in our own complete plants, and finished under our own improved methods, therefore, controlling every operation it is possible for us to offer a product of unsurpassed quality and "Service" is our watchword.

J & L Galvanized Nails

J & L GALVANIZED NAILS are manufactured under an improved process, which combines smooth surface, lustrous appearance and the ultimate in resistance to corrosion.

J & L GALVANIZED NAILS are packed in a distinctive GREEN KEG to permit of ready identification and to prevent confusion of stock.

The GREEN KEG is your insurance of J & L quality in GALVANIZED NAILS.

The Nails

All J & L Nails are made from carefully selected wire and particular care is used to insure accuracy as to length and gauge—clean surface, uniform heads and well cut points.

We manufacture a wide variety of Nails, each especially adapted for a given purpose and thus you may select the proper type and size best suited for your specific job. Among the varieties of nails we make are the following:

Barrel Nails	Finishing Nails
Berry Box Nails	Flooring Brads
Boat Nails	Foundry Nails
Box Nails	Hinge Nails
Car Nails	Lath Nails
Casing Nails	Marking Nails
Clinch Nails	Plaster Board Nails
Common Brads	Roofing Nails
Common Nails	Shingle Nails
Dating Nails	Siding Nails
Fence Nails	Slating Nails
Fine Nails	Spikes and Wire

Write for Nail Catalog



The Keg

All J & L Standard Wire Nails are packed in stout wooden kegs with flat steel hoops on the ends and two wire hoops at the bilge, thus insuring maximum strength—furthermore, the kegs are of an improved pattern, designed to conserve space and the contents are compactly filled.

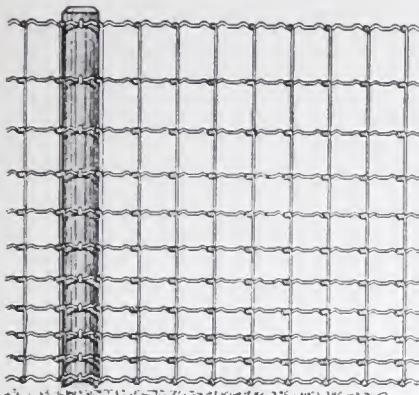
See Your Hardware Jobber

J & L CONSTRUCTION PRODUCTS

J & L Wire Products

A Few of Which Are Enumerated Below

J & L Standard Fence



J & L STANDARD FENCE is made in all of the standard specifications as approved by the U. S. Department of Commerce and every rod is fully guaranteed.

J & L CONSTRUCTION IS THE BEST



THE HINGE JOINT insures rigidity combined with the necessary flexibility for proper erection and severe service.

THE TENSION CURVES are placed on both sides of the hinge joint, thus preventing any possible slippage of the stay wires and providing sufficient elasticity or spring to properly take care of the expansion and contraction resulting from changes in temperature and to compensate any sudden or severe pressure.

THE GALVANIZING is of superior quality, a heavy, bright coating of pure spelter smoothly and evenly applied.

BUY IT—TRY IT—

THE PROOF OF VALUE
IS
THE TEST OF TIME

J & L Barbed Wire



J & L BARBED WIRE is offered in all popular patterns and is unexcelled whether used in separate construction or in conjunction with J & L Standard Fence.

All put up on our improved Metal Spool.

J & L Wire



We are prepared to furnish BRIGHT HARD WIRE, ANNEALED WIRE, GALVANIZED WIRE, BOLT WIRE, RIVET WIRE, SCREW WIRE, SPRING WIRE and other special grades and finishes.

Your Inquiries Invited

“LESSONS OF THE STORM”

J & L Track Spikes for Railroad, Mine and Industrial Uses



FULL line of all standard sizes of Railroad, Mine and Industrial Spikes is carried at Pittsburgh and in our several Warehouses for prompt shipment. All J & L Spikes are manufactured by the hot working process from new rolled steel bars, are true to dimension with full ample heads and sharp chisel points.

The A. R. E. A. standard design spike and also the standard spikes of several leading Railroads are carried in stock.

Spikes with special heads and points, including Goldies, to any Railroad Company's design and specification are made to order.

WE STRONGLY RECOMMEND COPPER BEARING STEEL SPIKES FOR LONG SATISFACTORY SERVICE.

J & L Light Rails and Accessories



JONES & LAUGHLIN make a specialty of light rails in weights 8 lbs. to 40 lbs. per yard. These rails with their accessories are especially adapted for the use of contractors, manufacturers and operators of ranches and plantations. All the material used in the manufacture of these rails and fittings is J & L steel.

Many miles of J & L rails and accessories are in constant daily use in our own iron ore mines, coal mines, limestone quarries, furnaces, mills and yards, and this use of our own material gives us knowledge of rail requirements for high efficiency in light trackage.

If you will consult us in the use of light rails, our experts will be glad to advise you fully as to proper material for your requirements.

Ask for Prices and Terms

J & L CONSTRUCTION PRODUCTS

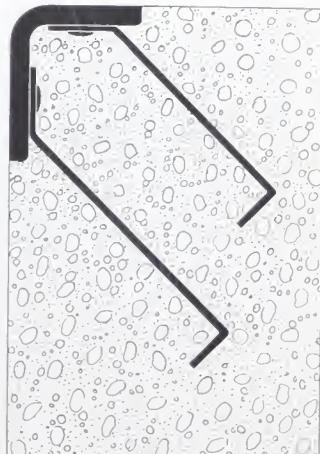
J & L Round-Backed Curb Angle Protects Costly Street Construction also Automobile Tires



Setting J & L heavy, round-backed curb angles on a street in Pittsburgh.

THERE is no doubt in the minds of experienced contractors about the value of the J & L curb angle for public thoroughfares as compared with unprotected concrete. The angle of steel, set firmly and properly, not only protects the concrete from breaking down under the blows and the wear of heavy tires, thus insuring longer life to the job, but at the same time safeguards the tires themselves.

Light angles, channels, plates and special shapes have been used for years, but it was found that hard blows loosened them and then the entire section of curbing had to be rebuilt. The fault lay in two things — too light protection and insufficient anchorage. The City of Pittsburgh solved the problem by adopting the J & L heavy round-backed angle, anchored every six inches by a $1'' \times \frac{1}{8}''$ flat bar attached by counter-sunk rivets. The anchorage may be extended so as to be used also as a reinforcement the full depth of the curb.



Detail of J & L Curb Angle

Write for Further Information

J & L CONSTRUCTION PRODUCTS

J & L Steel River Barges



This particular barge, one of a series built for a big Ohio river sand and gravel company, is 135 ft. long, 27 ft. wide and 8½ ft. deep, with steel cargo box 3 ft. 4 inches deep. End collision bulkheads, center longitudinal water-tight bulkhead and two additional cross water-tight bulkheads make it especially stout and dependable for work it is called upon to do year in and year out. Capacity, 660 tons at 7½ ft. draft.

WITH more than thirty years' experience in practical operation of fleets of towboats and barges on the Monongahela, Ohio and Mississippi rivers, with a highly technical engineering staff constantly in service, with a corps of trained workmen and unlimited supplies of the highest grade steel from the big Jones & Laughlin steel works, no one is better able to advise you on your river transportation problems than we are. Our long experience as operators of a river fleet of numerous towboats and more than 200 steel barges, qualifies us as experts in all practical barge construction problems. Let us estimate on your next order of barges.



This picture shows a fleet of J & L steel gondola barges in St. Louis with 5,000 tons of J & L steel pipe for the Western oil fields, which made the trip from the J & L mills in Pittsburgh, down the Ohio and up the Mississippi to destination in 10 days. The pipe was transferred at St. Louis to railroad cars and sent on its way. Jones & Laughlin were the pioneers in use of the Ohio and Mississippi rivers for distribution of steel products from Pittsburgh into the South and Southwest. They have warehouses at Cincinnati and Memphis for storage of steel products brought down by barge from their mills and later distributed inland.

Consult J & L Steel Construction Department

J & L CONSTRUCTION PRODUCTS

J & L Warehouse Service

Chicago Cincinnati Memphis Pittsburgh



Beam and Channel Bay in the J & L Pittsburgh Warehouse

To meet the demand for steel that emergency building operations require, the Jones & Laughlin Steel Corporation carries complete and comprehensive stocks of all steel employed in such operations at its several warehousing points—Chicago, Pittsburgh, Cincinnati and Memphis. Inquiries and orders should be addressed to the Warehouse Department, Pittsburgh.



Assembly and Loading Floor in the J & L Chicago Warehouse

Immediate Shipment Assured

J & L CONSTRUCTION PRODUCTS

J & L PRODUCTS

OPEN HEARTH AND BESSEMER STEEL

Hot Rolled Products

BILLETS	BLOOMS	SLABS	SHEET BARS	SKELP
BANDS	ROUNDS	FLATS	SQUARES	HEXAGONS
AGRICULTURAL SHAPES			SPECIAL SHAPES	
BARS FOR CONCRETE REINFORCEMENT				
ANGLES	TEES	BEAMS	ZEES	CHANNELS
PLATES FOR BRIDGES, TANKS, BOILERS, CARS AND SHIPS				
TIE PLATES LIGHT RAILS AND ACCESSORIES				

Railroad Spikes

Forging Steel

Jalcase Steel

HOT ROLLED OR COLD FINISHED

Junior Beams

Fabricated Structural Work

COLUMNS	GIRDERS	TRUSSES
PLATE WORK	STEEL BARGES	TANKS
MILL AND FACTORY BUILDINGS		

Cold Finished Steel

SHAFTING AND SCREW STOCK			
ROUNDS	SQUARES	HEXAGONS	FLATS
PUMP AND PISTON RODS			
SPECIAL SHAPES			

Tubular Products

STANDARD PIPE	LINE PIPE	CASING	TUBING
DRIVE AND ROTARY DRILL PIPE			

Wire Products

WIRE RODS			
BRIGHT, ANNEALED AND GALVANIZED WIRE			
SPRING WIRE	BARBED WIRE	WOVEN FENCING	
BRIGHT, COATED AND GALVANIZED NAILS			
FENCE STAPLES	NETTING STAPLES		

Tin Mill Products

COKE TIN PLATE	BLACK SHEETS (TIN MILL SIZES)
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Coke By-Products

Buy All Your Steel Requirements at One Place

J & L CONSTRUCTION PRODUCTS

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS

FOUNDED 1850

General Offices

JONES & LAUGHLIN BUILDING, PITTSBURGH, PA.

District Sales Offices

BOSTON	BUFFALO	CHICAGO	CINCINNATI
CLEVELAND	DENVER	DETROIT	LOS ANGELES
MEMPHIS	MILWAUKEE	MINNEAPOLIS	NEW YORK
PHILADELPHIA	PITTSBURGH	SAN FRANCISCO	ST. LOUIS
	SEATTLE	WASHINGTON	

Warehouses

CHICAGO	CINCINNATI	MEMPHIS
	PITTSBURGH	

Manufacturing Plants

PITTSBURGH WORKS, PITTSBURGH, PA.

ALIQUIPPA WORKS, WOODLAWN, PA.

Consult Nearest Office for Further Information



THE EMBLEM OF THE
JUNIOR BEAM

THE MOST FORWARD STEP IN
CONSTRUCTION SINCE STRUC-
TURAL STEEL WAS INTRODUCED